LENGTH AND WEIGHT OF FISH DELIVERED BY THICK-BILLED MURRES TO THEIR CHICKS AT DIGGES, COBURG AND COATS ISLANDS, N.W.T., 1980-1987

Environment CANADA Environnement
20460806 VOL ISS 5 1987
EXC # 001
SK 470 T42
TECHNICAL REPORT SERIES (CANADIAN W
ILDLIFE SERVICE)
00FF

A.J. Gaston

TECHNICAL REPORT SERIES No. 5
Headquarters 1987
Canadian Wildlife Service

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88-01163/

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This series may be cited as
Gaston, A.J. 1987. Length and
weight of fish delivered by
Thick-billed Murres to their
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Coats islands, N.W.T. 1980-1987.
Technical Report Series, Headquarters.

Published by authority of the
Minister of the Environment
Canadian Wildlife Service

© Minister of Supply and Services Canada 1987
Catalogue No. CW69-5/5E
ISBN 0-662-15709-5
ISSN 0831-6481

Copies may be obtained from:

Canadian Wildlife Service
Wildlife Toxicology and Surveys Branch
Environment Canada
National Wildlife Research Centre
Ottawa K1A 0H3

Abstract

Data on the length and weight of fish delivered by Thick-billed Murres *Uria lomvia* to their chicks at Digges (62°34'N, 77°59'W), Coats (62°57'N, 82°00'W) and Coburg (75°48'N, 79°25'W) islands during 1980-1987 are summarized. Length-weight relationships are given for the eleven most common species collected. Comparable data derived from the literature and from unpublished records of the Fisheries Research Board of Canada are also presented.

Abrégé

Nous résumons nos données sur la longueur et le poids des poissons apportés par les Marmettes de Brünnich à leurs petits pour la période de 1980 à 1987 aux îles de Digges, Coats et Coburg. Les relations poids-longueur sont calculées pour les onze espèces de poissons les plus communes. Nos données comparables proviennent d'autres publications scientifiques ainsi que des données inédites de l'Office des recherches sur les pêcheries du Canada.

Acknowledgements

I would like to thank D.E. McAllister of the National Museum of Natural Sciences for confirming the identification of most of the specimens, for loaning me the material deposited at the museum by the Fisheries Research Board of Canada, and for general encouragement. D.G. Noble assisted with the identification of specimens collected in 1986 and 1987, and he and other members of the C.W.S. field camps at Digges, Coats and Coburg islands, contributed to the specimen collections. I must also thank D.K. Cairns and J.M. Green of Memorial University, St. John's, for data on fish collected at Nuvuk Islands. H. Boyd kindly commented on the manuscript.

Introduction

Fish found on the breeding ledges were collected in the course of field work carried out at the Thick-billed Murre colonies on Digges, Coats and Coburg islands during 1980-1987. Where the specimens were fresh and complete they were weighed and their fork-lengths measured immediately after returning to camp. They were then preserved in 70% isopropyl alcohol for subsequent identification.

This report is a preliminary attempt to summarize data on the fish collected, particularly where it relates to length-weight relationships. Knowledge of length-weight relationships is useful in determining the weight at delivery of fish collected in dehydrated condition (sometimes a large proportion of those found), or of fish seen delivered, where the length could be accurately estimated.

Information from other studies in the North American arctic, and data from the Fisheries Research Board of Canada files now deposited with the National Museum of Natural Sciences, are also included where relevant. The Fisheries Research Board data are based on collections made throughout Canadian arctic waters and hence are not localized to a particular area. Nomenclature follows Hunter et al. (1984).

Arctic Cod, Boreogadus saida

Fish delivered to chicks ranged from 60-196 mm in length and up to a maximum of 41.5 g in weight. Lengths varied significantly among years at Digges Island, but not at Coats Island. When years were combined, fish collected at Coats Island were significantly longer than those collected at Digges Island (Figure 1).

Young of the year Arctic Cod average 20-30 mm in length in August-September (Sekerak 1982). By June of the next year (age approximately 1 year) they average c. 60 mm (Bradstreet 1982). By the following winter (approximately 1½ years) they are c. 84 mm long, at 2½ they are c. 128 mm, at 3½ c. 159 mm and at 4½ c. 180 mm (Craig et al. 1982). Roughly comparable data are given by Lowry and Frost (1981). Summer lengths-at-age are not available but it seems probable that second year fish would be less than 80 mm, third year fish c. 80-120 mm and fourth year fish c. 120-150 mm.

On this basis 34% of Arctic Cod collected at Coats Island were in their third and 39% in their fourth years (N = 107). Corresponding proportions at Coburg Island were 46% and 34% (N = 41) and at Digges Island, 52% and 24% (N = 46). Arctic Cod usually begin spawning in the third (males) or fourth (females) years (Craig et al. 1982). Hence more of the fish taken at Coats Island were likely to have been sexually mature than those taken at Digges Island.

No difference was apparent among Arctic Cod collected at Digges, Coats and Coburg islands in the relationship between length and weight (Figure 2). However, there was some indication that those collected at Coats Island in 1985 were heavier at a given length than those collected in 1984 and 1986 (Figure 3). No inter-year differences were apparent at Digges Island (Figure 4). The best fit formula for weight in relation to length (weight(g) = $3.625 * 10^{-6} * (\text{length})^{3.114}$, where length is in mm) gives similar estimates over the commonest size range (100-150 mm) to formulae given by the Fisheries Research Board data and by Frost and Lowry (1981), based on fish collected in the Bering, Chukchi and Beaufort Seas. However, the function calculated by Craig et al. (1982) for fish collected in Simpson Lagoon, Beaufort Sea, suggests greater weights at a given length (Table 1).

Mean weights of Arctic Cod varied significantly among years at Digges Island, but not at Coats Island. All means at Coats Island were higher than any at Digges Island (Table 2). Mean weight at Coburg Island was not significantly different from any single year sample at Coats Island, but was significantly heavier than the 1981 and 1982 means at Digges Island.

Capelin, Mallotus villosus

There was no significant difference in length among samples of Capelin obtained in any year at either Digges or Coats Islands. The range in size was rather small with 48% of the combined sample (N = 46) having a fork length between 105-115 mm, and the maximum length not exceeding 150 mm (Figure 5). Males are larger than females at maturity in this species, but even two year old females, the youngest spawning age, average 142 mm (Templeman, in Jangaard 1974). Hence most of the fish collected were presumably pre-spawning and probably less than two years old. No gravid females were noted.

Weights averaged 5.8 g for the combined sample. Weights in relation to length for the Coats Island sample are shown in Figure 6. Comparing weights at length with those estimated by the formula given for males only from Newfoundland by Winters (1970) suggests that the Hudson Bay fish are heavier for a given length (Figure 7). However, most of the largest Capelin were collected at Coats Island in 1986 and a year class effect is also possible.

Sand Lance, Ammodytes spp.

Both the American Sand Lance, Ammodytes dubius, and the Stout Sand Lance, A. hexapterus were identified at Coats Island and the former species also at Digges Island. However, the majority of specimens obtained were not identified to species.

Yearly samples were relatively small and no inter-year or inter-colony differences could be detected. The combined sample averaged 100 mm in length and 1.76 g in weight (Table 2).

Sculpins, Cottidae

Three species of Sculpin, all members of the genus Triglops, were collected at Digges Island and four: Triglops pingeli, Gymnocanthus tricuspis, Icelus spatula and Myoxocephalus scorpius at Coats Island. Samples of most species were in single figures and only the Ribbed Sculpin, Triglops pingeli and the Bigeye Sculpin, T. nybelini will be dealt with in detail here.

Twenty-four of the thirty-eight Triglops specimens collected on Coats Island were identified as T. pingeli. A single specimen of T. murrayi was the only other Triglops species identified from that colony. Interestingly, T. pingeli is the only Triglops species recorded for Melville Peninsula and Southampton Island by Stewart and Bernier (1984). At both Digges and Coburg islands T. pingeli, T. nybelini and T. murrayi were all identified. Apparently T. pingeli occurs commonly to the west of Hudson Strait, as indicated by Hunter et al. (1984).

Fork lengths of Ribbed Sculpins ranged from 65-150 mm (Figure 8). The majority of those 120 mm or longer collected at Coats Island in 1986 were gravid females, hence fish of this size can be regarded as mature. The presence of large egg-masses presumably affects the relationship between length and weight (Figure 9). However, the best-fit formula obtained gave similar predictions to that obtained from the Fisheries Research Board data over the range of lengths observed. Weights of Bigeye Sculpins were similar to those of Ribbed Sculpins for a given length (Figure 10), although the Fisheries Research Board formula suggests that at

the upper end of the size range Bigeye Sculpins should be much larger (52 g vs. 28 g for 150 mm fish). However, the sample used to calculate the Fisheries Research Board function was rather small.

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Table 1. Length-weight formulae ($Y(g) = A \times X^B$ (mm), except where otherwise specified).

Species	Area	A ($\times 10^{-6}$)	s.d.	B	s.d.	R^2	N	Wt. of 100 mm fish
Capelin *Mallotus villosus*	Coats Is.	0.103	0.154	3.794	0.321	0.819	33	3.99
	Coats & Digges Is.	0.057	0.067	3.920	0.253	0.851	44	3.92
	Newfoundland (immatures)[1]	13.800		2.72		0.82	121	3.80
Arctic Cod *Boreogadus saida*	Coats Is.	9.250	2.587	2.929	0.058	0.960	107	6.67
	Coats & Digges Is.	3.625	1.079	3.114	0.062	0.943	153	6.13
	Coburg Is.	7.553	3.882	2.975	0.107	0.952	41	6.73
	FRB[2]	1.20		0.0148			828	5.27
	Beaufort Sea[3]	-5.196		3.031		0.960	277	7.36
	Bering, Chukchi and Beaufort Seas[4]	0.0018		3.50		0.987	118	5.69
Fish Doctor *Gymnelus viridis*	Coats & Digges Is.	0.768	0.0172	0.0172	0.002	0.829	17	4.29
	FRB	0.16		0.0278			78	2.58
	Nuvuk Islands (1)[5]	0.492	0.179	3.407	0.078	0.983	50	3.21
Fourline Snake Blenny *Eumesogrammus praecisus*	Coats Is.	2.445	3.637	3.208	0.309	0.931	12	6.37
	Nuvuk Islands (1)	1.105	0.248	3.414	0.048	0.990	50	7.43
Daubed Shanny *Leptoclinus maculatus*	FRB	0.12		0.2931			17	2.25

Species	Area	A ($\times 10^{-6}$)	s.d.	B	s.d.	R^2	N	Wt. of 100 mm fish
Arctic Shanny *Stichaeus punctatus*	Nuvuk Islands (1)	1.485	0.515	3.271	0.078	0.974	50	5.18
	Nuvuk Islands (2)[6]	1.679	1.014	3.230	0.122	0.959	32	4.89
Sand Lance *Ammodytes* spp.	Digges Is.	6.317	10.495	2.771	0.362	0.765	20	2.20
	Coats & Digges Is.	5.283	6.418	2.828	0.260	0.814	29	2.39
	FRB	0.34		0.0235			222	3.56
	Newfoundland[1]	209.0		2.11		0.93	45	3.47
Shorthorn Sculpin *Myoxocephalus scorpius*	FRB	16.74		0.0098			240	44.60
Ribbed Sculpin *Triglops pingeli*	Coats Is.	1.819	1.190	3.268	0.138	0.941	37	6.25
	FRB	0.32		0.0298			38	6.30
Bigeye Sculpin *Triglops nybelini*	FRB	0.09		0.0424			15	6.25
Gelatinous Snailfish *Liparis fabricii*	Nuvuk Islands (1)	0.795	0.695	3.007	0.220	0.921	18	0.82
	FRB	0.19		0.0417			32	12.30

1 From J. Piatt, A. Burger and D.N. Nettleship, unpublished, quoted in Piatt (1986).
2 FRB = Fisheries Research Board; data deposited with National Museum of Natural Sciences, comes from sampling throughout the Canadian arctic. Formula used is $Y(g) = A * Exp(B * X)(mm)$, A has not been multiplied by 10^6.
3 Data from Craig et al. (1982). Formula used is $\log Y = A + (B * \log X)$, based on summer data from Simpson Lagoon. A has not been multiplied by 10^6.
4 Formula from Frost and Lowry (1981); based on a collection from the Bering, Chukchi and Beaufort Seas in May-October.
5 Data from J.M. Green, Memorial University; derived from fish obtained by divers.
6 Data from D.K. Cairns; fish delivered to Black Guillemot chicks.

Table 2. Mean length and weights of commoner species.

Colony	Year	Length (m) $\bar{x}$	s.d.	N	Weight(g) $\bar{x}$	s.d.	N
Boreogadus saida							
Digges Island	1980	116.7	33.3	22	12.5	8.5	22
	1981	111.9	24.4	17	9.5	6.8	17
	1982	102.0	18.1	7	3.9	2.3	7
	Combined	112.8*	28.5	46	10.3	8.0	46
Coats Island	1984	127.5	40.8	13	17.5	12.7	13
	1985	122.3	31.9	32	16.2	10.5	32
	1986	130.4	20.4	30	14.5	6.0	30
	1987	129.7	29.1	32	15.9	9.4	32
	Combined	127.3*	29.2	107	15.6	9.3	107
Coburg Island	1987	123.3	23.0	45	13.6	7.0	41
Mallotus villosus							
Digges Island	All years	105.1	14.1	11	5.3	3.8	11
Coats Island	1984	110.4	8.4	13	5.6	2.7	13
	1985	97.5	21.6	8	5.2	4.2	8
	1986	111.7	9.4	12	7.2	2.4	12
	Combined	107.5	13.7	33	5.8	2.7	33
Triglops pingeli							
Coats Island	1985	102.5	19.8	8	8.2	4.2	8
	1986	121.0	21.5	20	13.6	7.4	20
	1987	123.6	20.3	9	12.6	7.3	9
	Combined	116.7	22.1	37	11.9	7.0	37
Ammodytes spp.							
Digges Island	All years	100.0	22.2	20	2.6	1.8	20

* Difference significant, Mann-Whitney U = 2164, Z = 2.341, P = 0.019

FIGURE CAPTIONS

Figure 1. Length distributions of Arctic Cod collected at Digges (1980-1982), Coats (1984-1987) and Coburg (1987) islands.

Figure 2. Comparison of length-weight relationships for Arctic Cod collected at Coats, Digges and Coburg islands.

Figure 3. Length-weight relationship for Arctic Cod collected at Coats Island.

Figure 4. Length-weight relationship for Arctic Cod collected at Digges Island.

Figure 5. Length distribution of all Capelin collected.

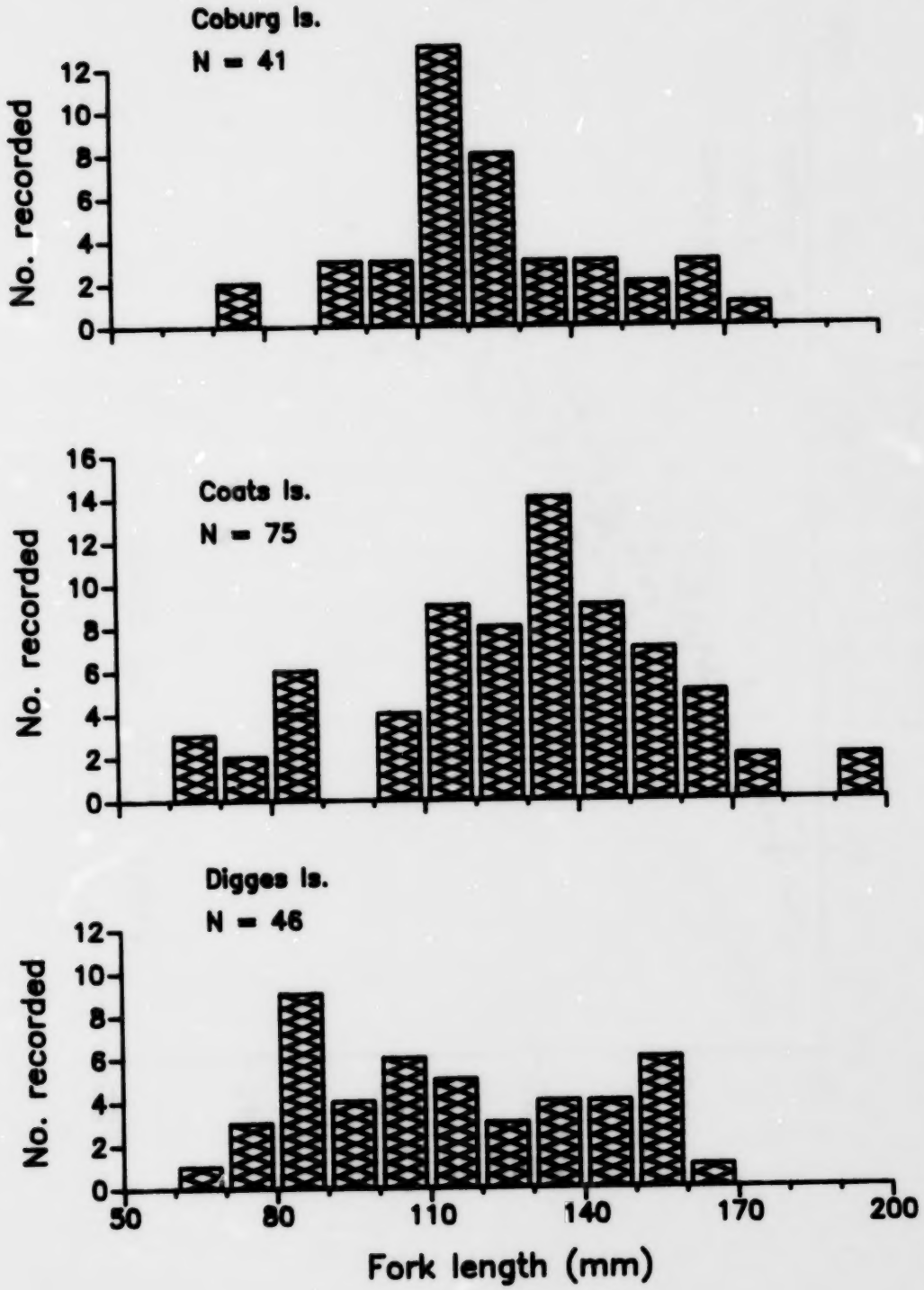
Figure 6. Length-weight relationship for Capelin collected at Coats Island.

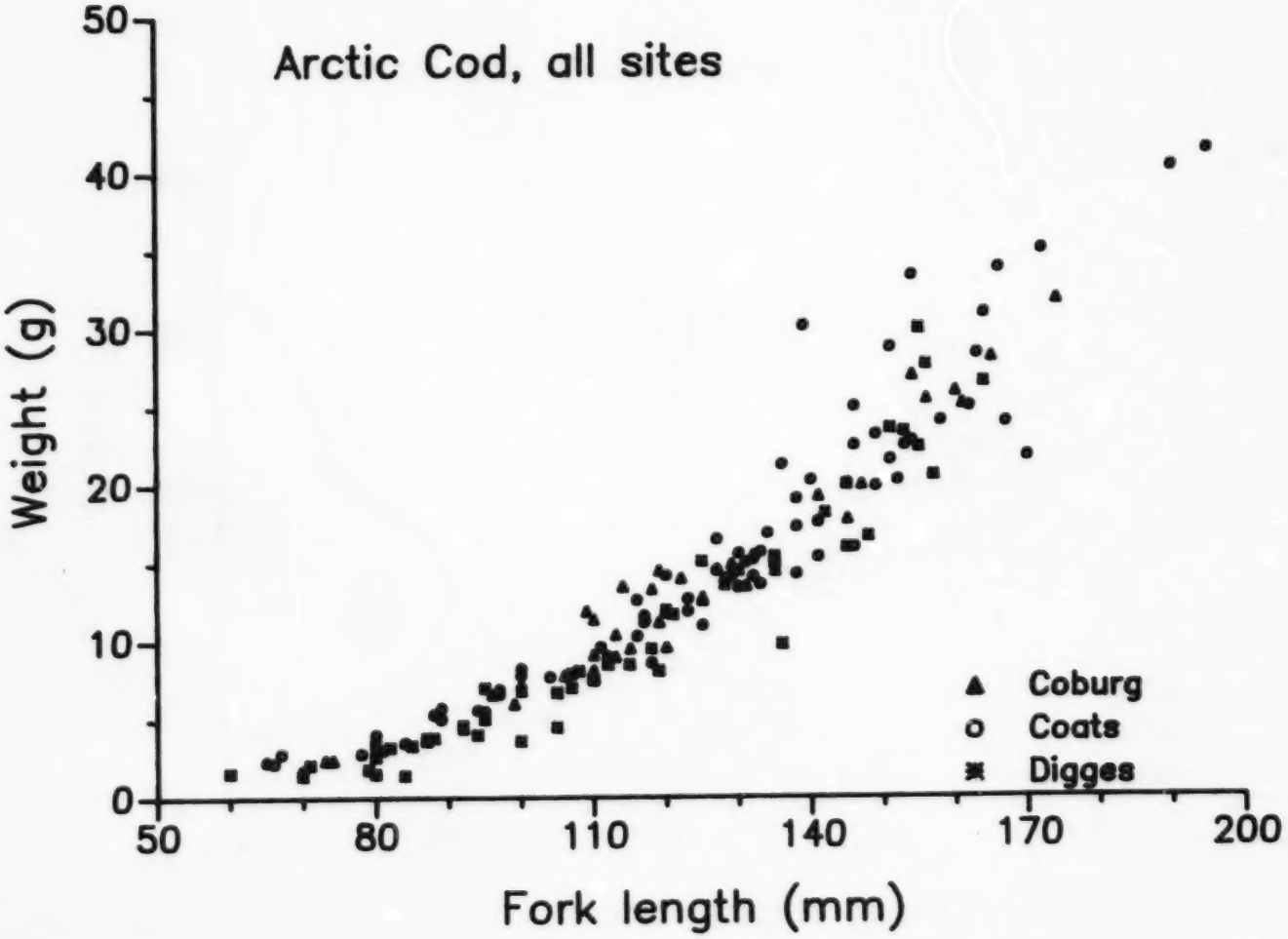
Figure 7. Length-weight relationship for Capelin at Coats Island compared with the best-fit line estimated for male Capelin in Newfoundland.

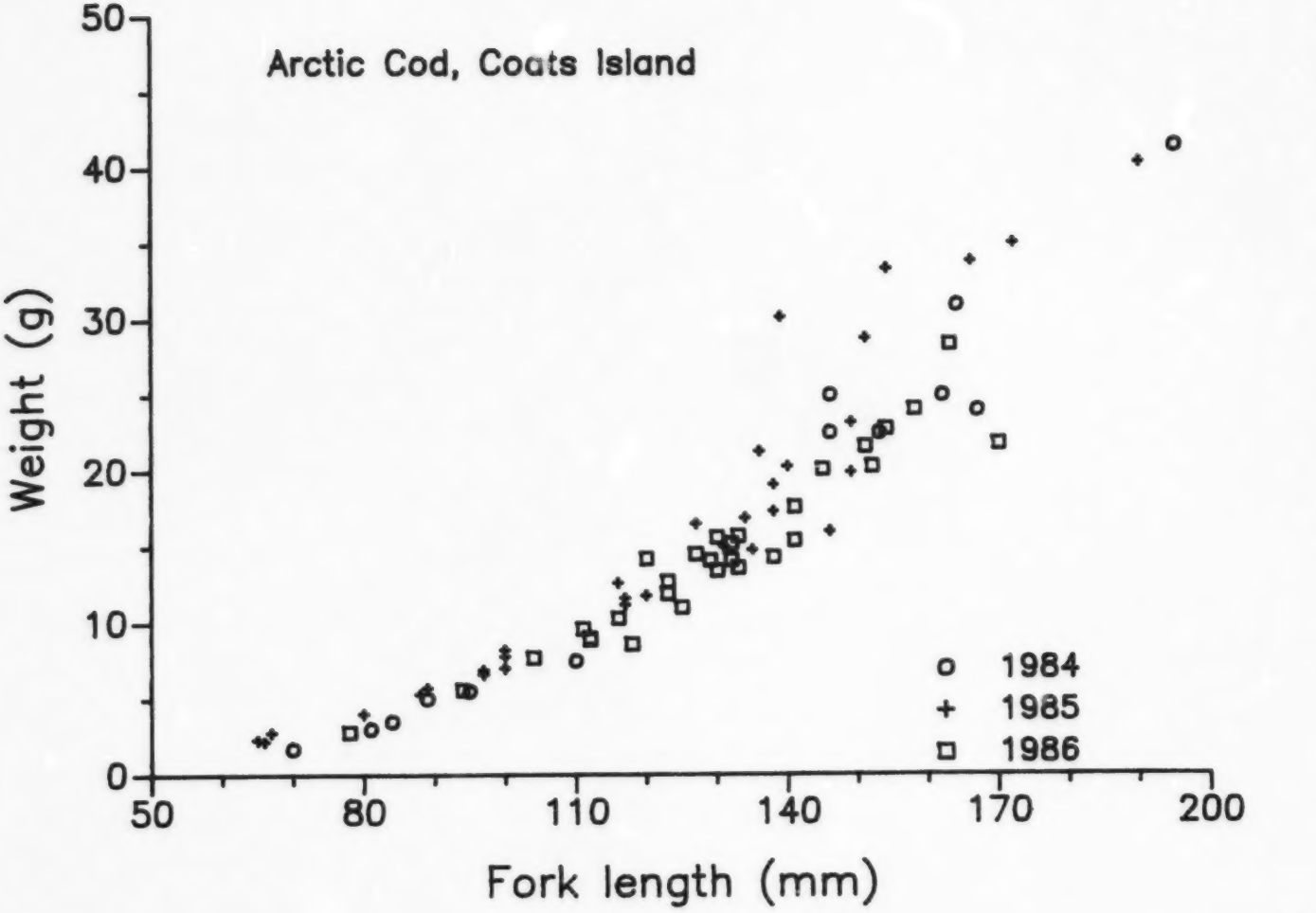
Figure 8. Length distributions of Ribbed Sculpin at Coats Island in 1985 and 1986.

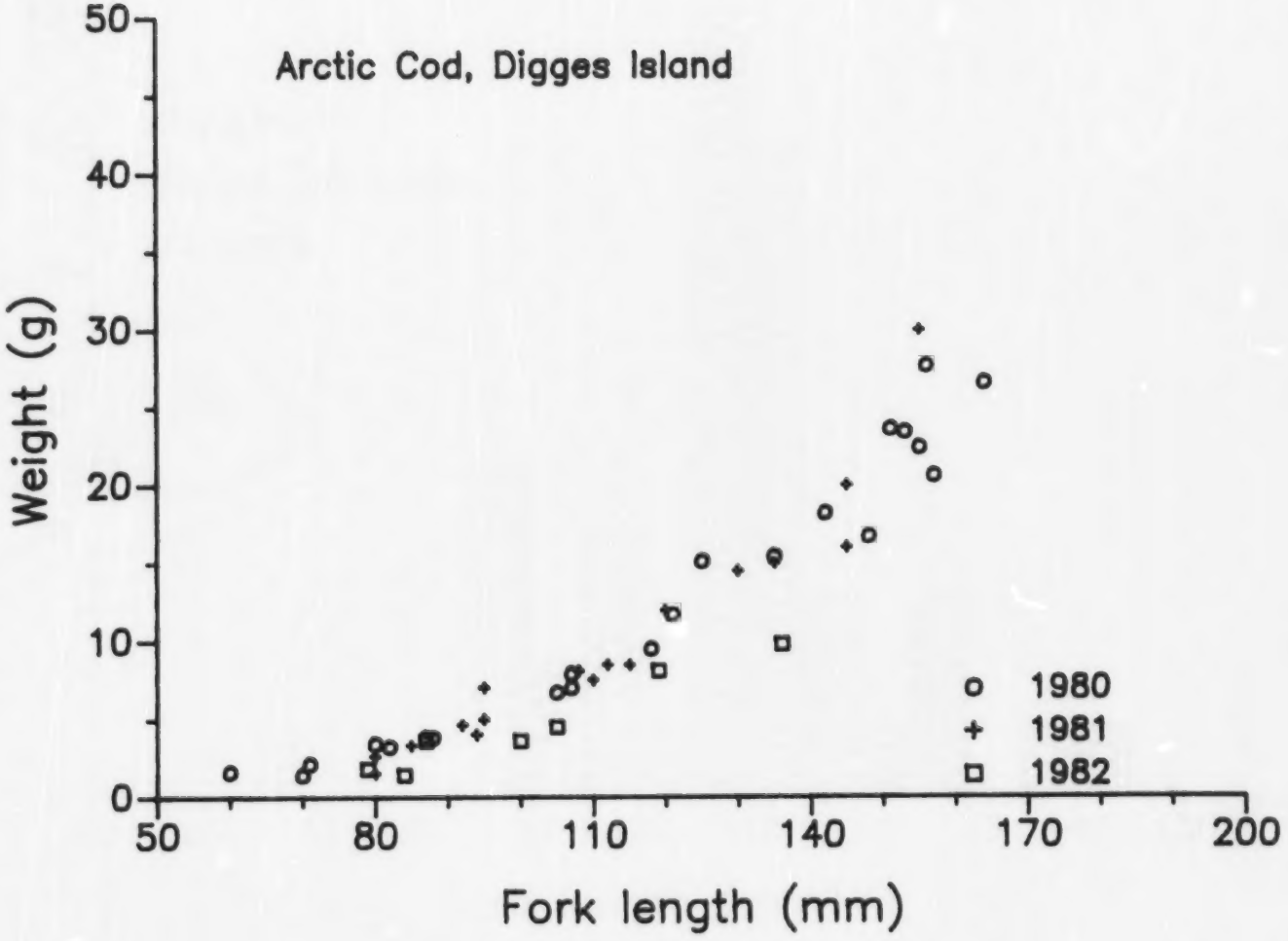
Figure 9. Length-weight relationship for Ribbed Sculpin at Coats Island.

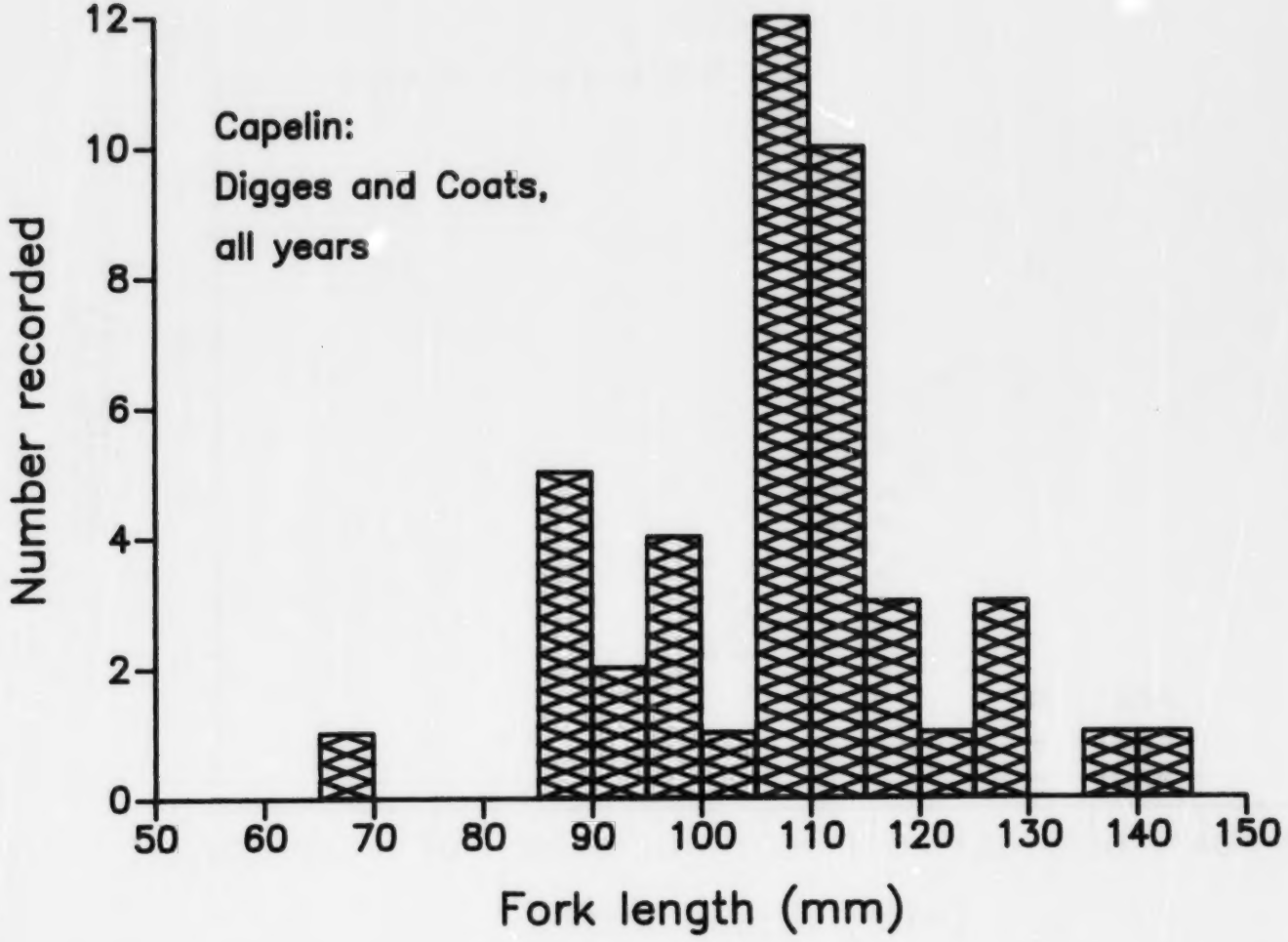
Figure 10. Comparison of length-weight plots for Ribbed and Bigeye Sculpins.

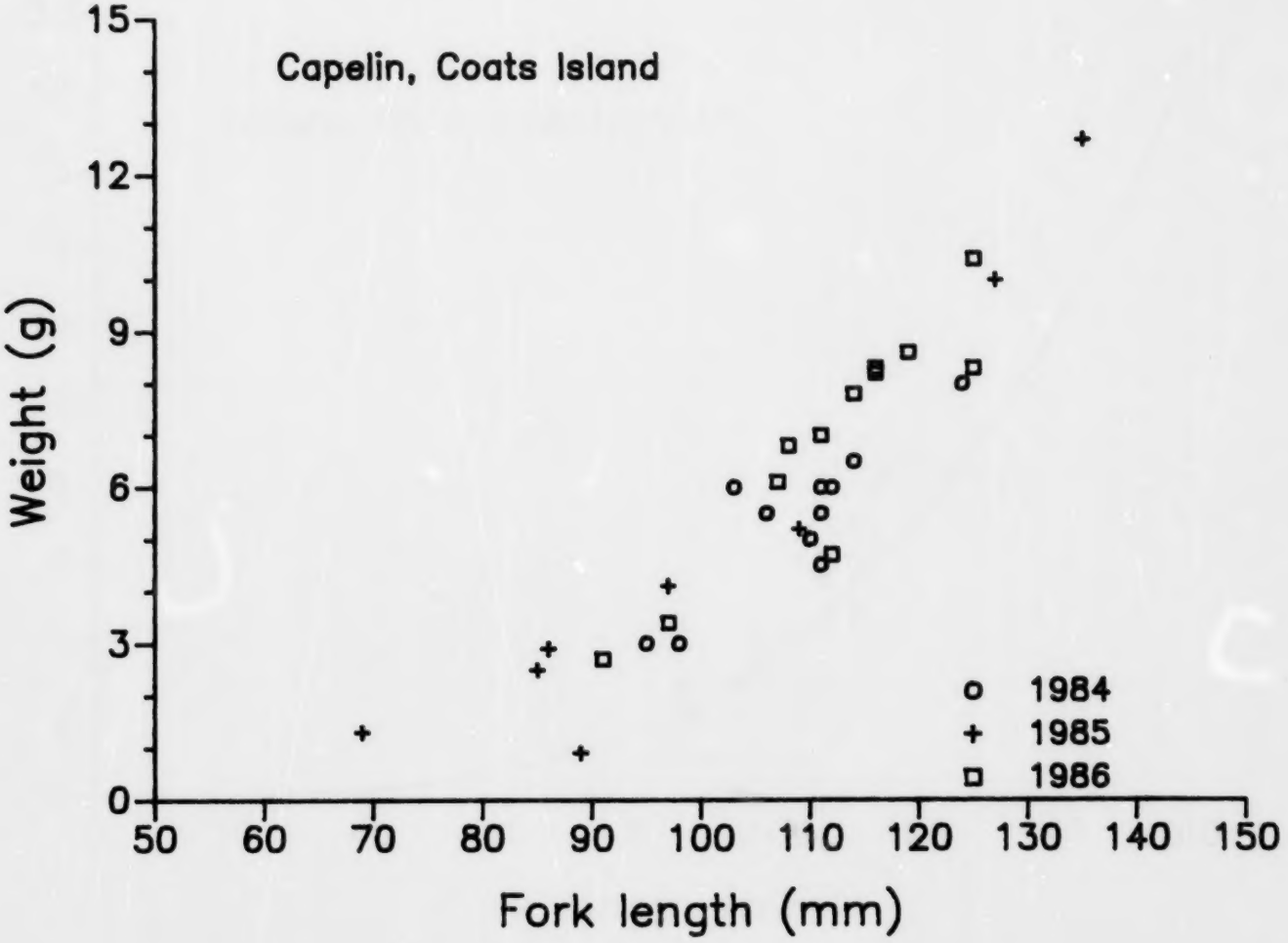

Coburg Is.
N = 41
No. recorded
0
2
4
6
8
10
12
Coats Is.
N = 75
No. recorded
0
2
4
6
8
10
12
14
16
Digges Is.
N = 46
No. recorded
0
2
4
6
8
10
12
50
80
110
140
170
200
Fork length (mm)

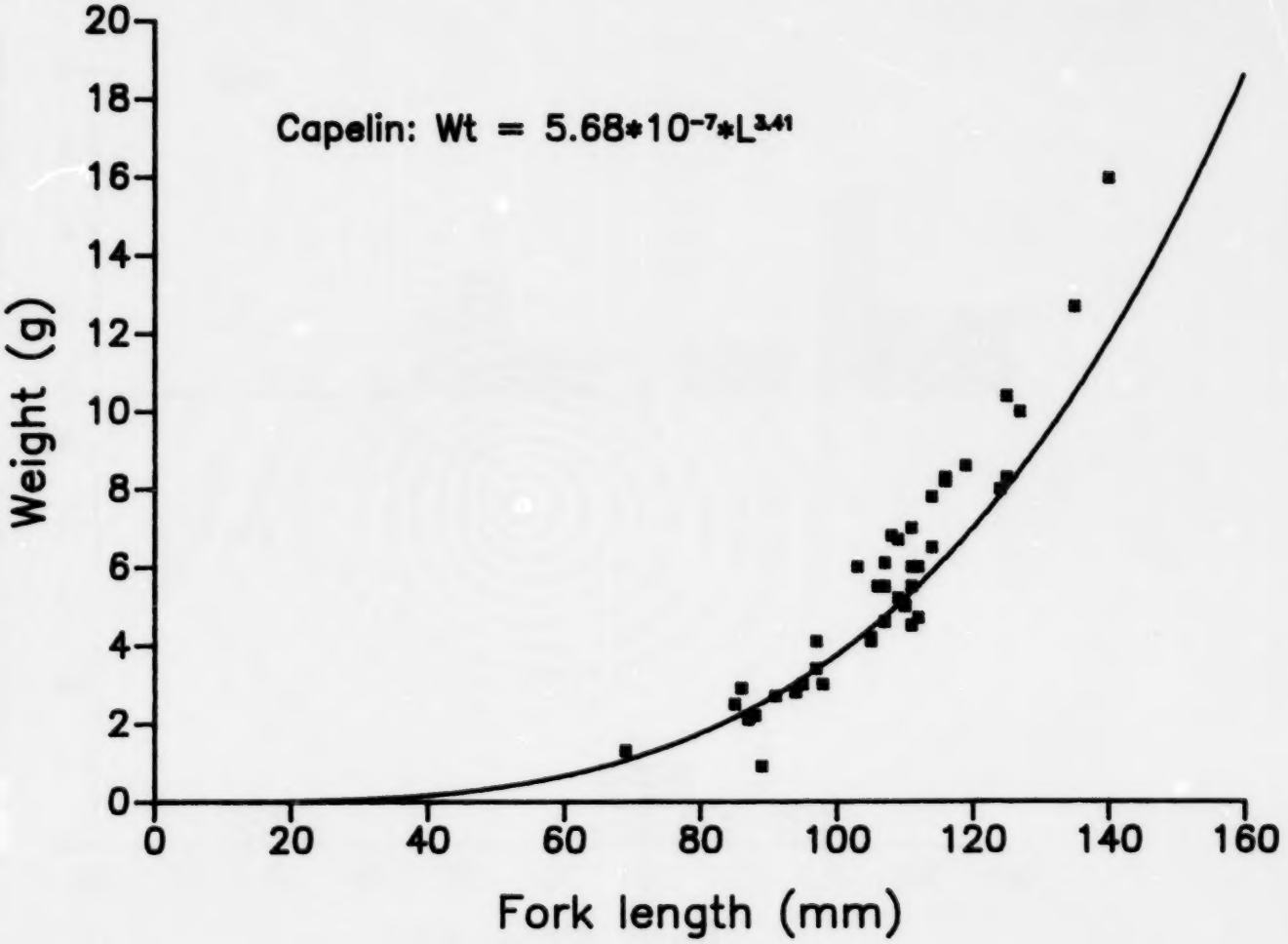

Arctic Cod, all sites
Weight (g)
0
10
20
30
40
50
50
80
110
140
170
200
Fork length (mm)
Coburg
Coats
Digges

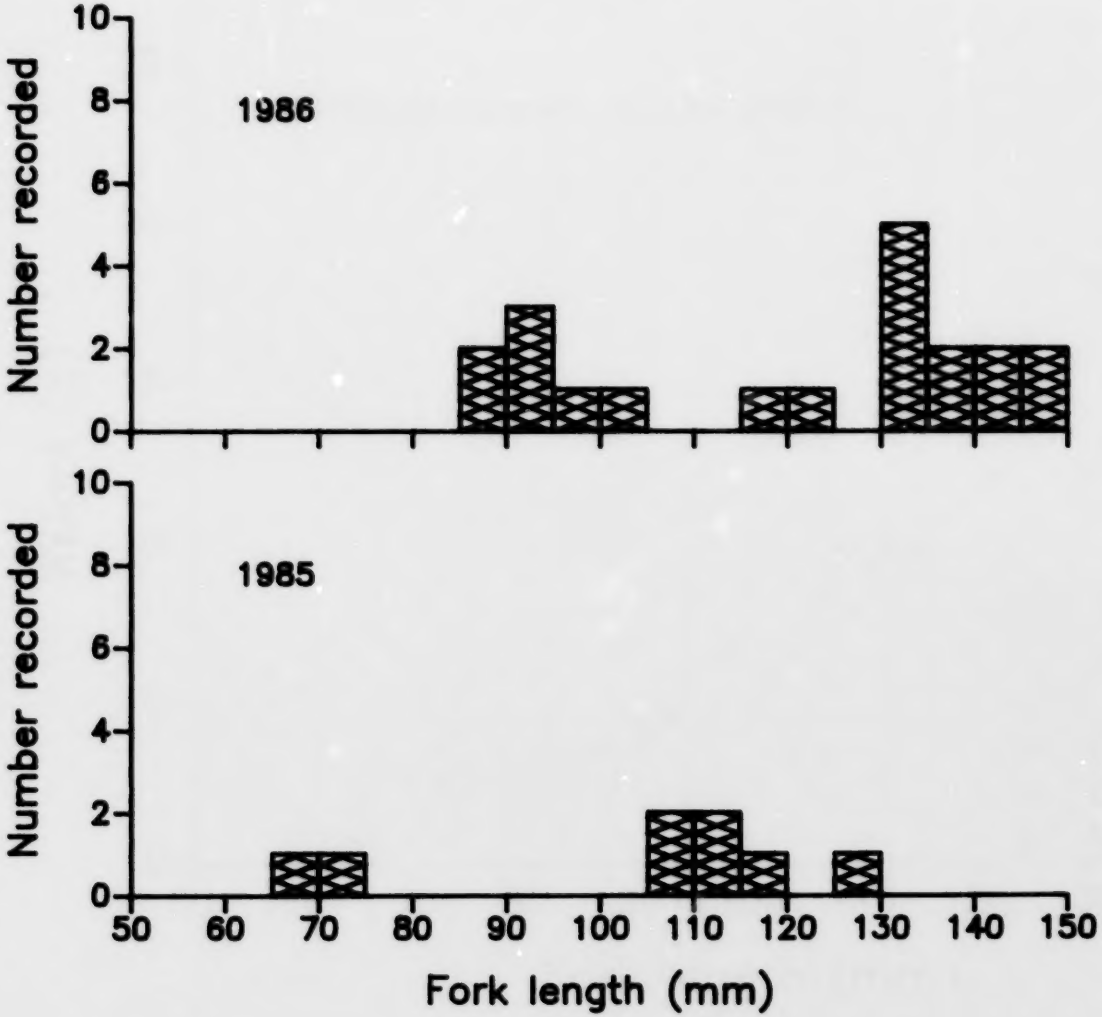

Arctic Cod, Coats Island
Weight (g)
Fork length (mm)
0
10
20
30
40
50
50
80
110
140
170
200
1984
1985
1986

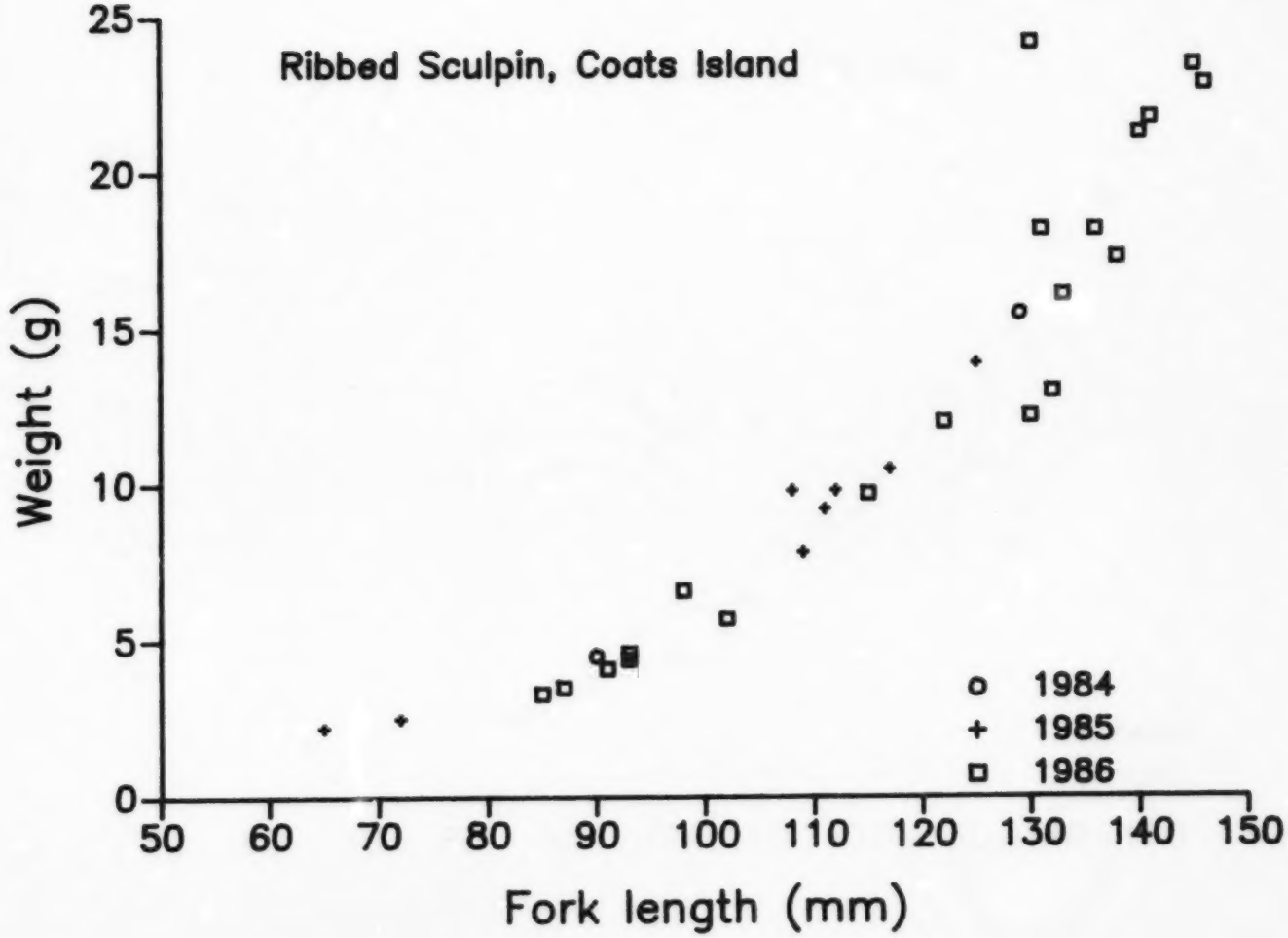

Arctic Cod, Digges Island
Weight (g)
0
10
20
30
40
50
50
80
110
140
170
200
Fork length (mm)
1980
1981
1982

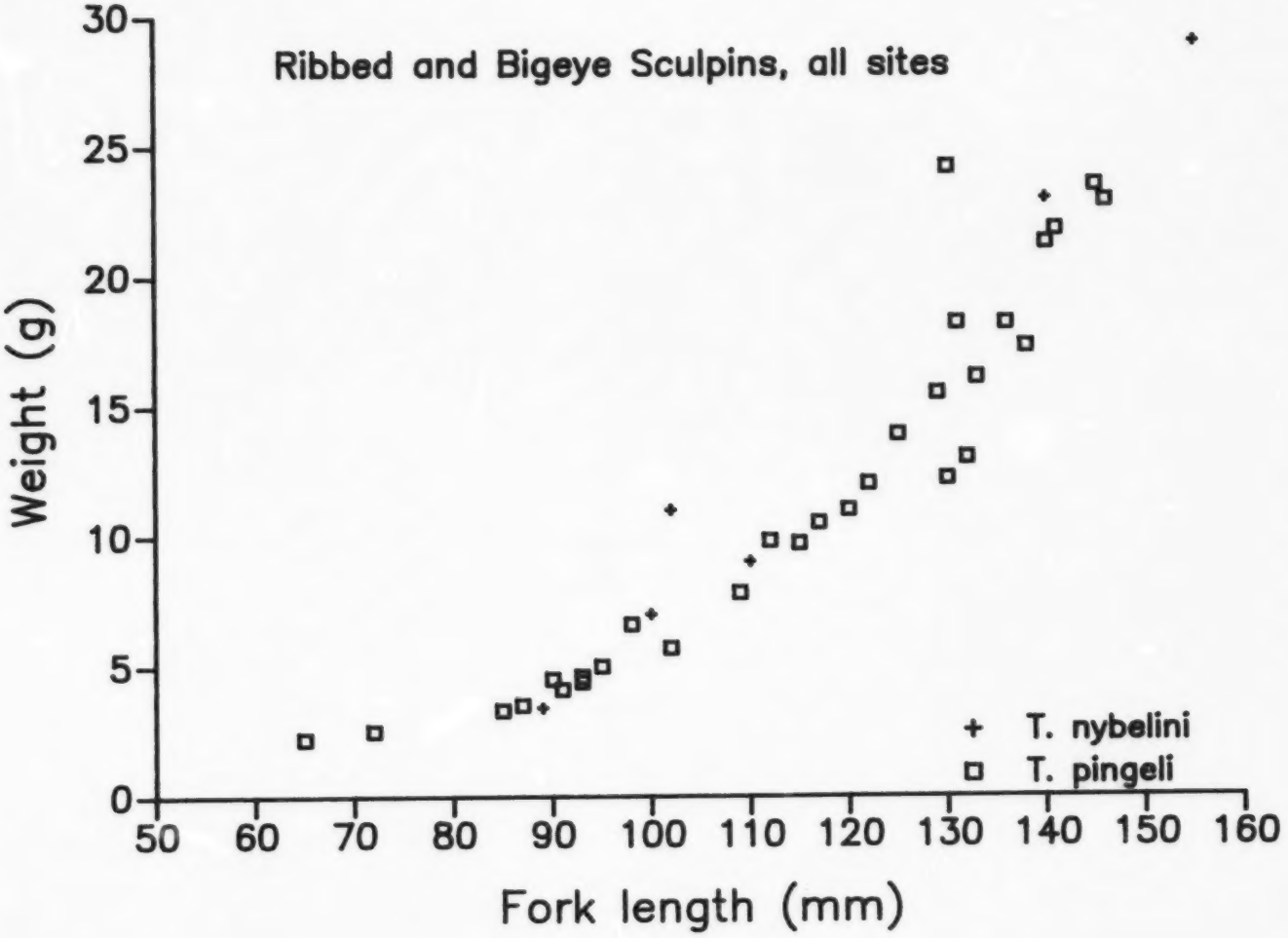

Capelin:
Digges and Coats,
all years
Number recorded
0
2
4
6
8
10
12
50
60
70
80
90
100
110
120
130
140
150
Fork length (mm)


Capelin, Coats Island
Weight (g)
Fork length (mm)
0
3
6
9
12
15
50
60
70
80
90
100
110
120
130
140
150
1984
1985
1986


Capelin: Wt = 5.68*10⁻⁷*L^3.41
Weight (g)
Fork length (mm)
0
2
4
6
8
10
12
14
16
18
20
0
20
40
60
80
100
120
140
160


1986
1985
Number recorded
Number recorded
0
2
4
6
8
10
50
60
70
80
90
100
110
120
130
140
150
Fork length (mm)


Ribbed Sculpin, Coats Island
Weight (g)
25
20
15
10
5
0
50
60
70
80
90
100
110
120
130
140
150
Fork length (mm)
1984
1985
1986


Ribbed and Bigeye Sculpins, all sites
Weight (g)
30
25
20
15
10
5
0
50
60
70
80
90
100
110
120
130
140
150
160
Fork length (mm)
T. nybelini
T. pingeli